



Pan Am Railways

2020 Wetland Report

Iron Horse Park Superfund Site: AOC 3

Billerica, Massachusetts

30 December 2020

Project No.: 0476110

Document details	The details entered below are automatically shown on the cover and the main page footer. PLEASE NOTE: This table must NOT be removed from this document.
Document title	2020 Wetland Report
Document subtitle	Iron Horse Park Superfund Site: AOC 3
Project No.	0476110
Date	30 December 2020
Version	1.0
Author	ERM Consulting & Engineering, Inc.
Client Name	Pan Am Railways

Signature Page

30 December 2020

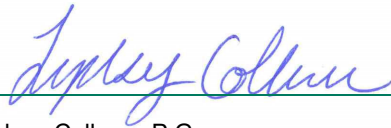
2020 Wetland Report

Iron Horse Park Superfund Site: AOC 3

Billerica, Massachusetts



Stacey Harvey, P.E.
Principal Consultant



Lyndsey Colburn, P.G.
Partner in Charge

ERM Consulting & Engineering, Inc.

One Beacon Street, 5th Floor
Boston, Massachusetts
02108

© Copyright 2020 by ERM Worldwide Group Ltd and/or its affiliates ("ERM").
All rights reserved. No part of this work may be reproduced or transmitted in any form,
or by any means, without the prior written permission of ERM.

CONTENTS

1.	INTRODUCTION	1
2.	WETLAND CONSTRUCTION AND PERFORMANCE CRITERIA	1
3.	WETLAND MONITORING METHODOLOGY, RESULTS, AND CORRECTIVE ACTIONS	4
3.1	Areal Vegetation Coverage.....	4
3.1.1	Corrective Actions	5
3.2	Vegetation Richness.....	5
3.3	Hydrology Indicators	7
3.4	Survivability and Tree Heights	7
3.4.1	Corrective Actions	9
3.5	Photographic Stations.....	9
3.6	Invasive Species	9
3.6.1	Corrective Actions	10
4.	CONCLUSION.....	11
5.	REFERENCES	12

APPENDIX A FIGURES

APPENDIX B LATE SPRING PHOTOGRAPHIC LOG

APPENDIX C LATE SUMMER PHOTOGRAPHIC LOG

APPENDIX D HYDROLOGY AND VEGETATION DATA FORMS

List of Tables

Table 1: Wetland Mitigation Performance Goals	1
Table 2: Wetland Mitigation Area Inspection and Monitoring Schedule for AOC 3	3
Table 3: 2020 Areal Coverage by Native Wetland Vegetation by Sampling Plot, Assuming American Barnyard Grass (<i>Echinochloa muricata</i>)	5
Table 4: 2020 Areal Coverage by Native Wetland Vegetation by Sampling Plot, Assuming Non-native Common Barnyard Grass (<i>Echinochloa crus-galli</i>).....	5
Table 5: Comprehensive List of Vegetative Species Observed in the Wetland Areas of AOC 3 (Year 2) ...	6
Table 6: Wetland Hydrology Indicators by Sampling Plot Late Summer 2020	7

Acronyms and Abbreviations

Name	Description
AOC	Area of Concern
ERM	ERM Consulting & Engineering, Inc.
FAC	Facultative
OBL	Obligate
Pan Am	Pan Am Railways
PEM	Palustrine emergent
Plan	Wetland Restoration and Creation Plan
Site	Iron Horse Superfund Site
SWCA	SWCA Environmental Consultants

1. INTRODUCTION

On behalf of Pan Am Railways (Pan Am) (formerly Boston and Maine Corporation), ERM Consulting & Engineering, Inc. (ERM) has prepared this Wetland Monitoring Report for the Iron Horse Superfund Site (Site) Area of Concern (AOC) 3. This report was prepared in accordance with the *Wetland Restoration and Creation Plan* (Plan) and documents the results of field investigations, observations, and actions taken during calendar year 2020 (Monitoring Year 2).

The Site is in North Billerica, Massachusetts and is part of a 553-acre industrial complex that dates back to 1913 (USEPA 2018). The Site consists of rail yard facilities, landfills, and wastewater lagoons. AOC 3 is approximately 4 acres on the southwest portion of the Site. AOC 3 contains two former Boston and Maine locomotive shop disposal areas (AOC 3A and 3B; USEPA, 2018). The area is bordered by railroad tracks (owned by Boston and Maine) to the north and west. There is a large parking lot and a FedEx package facility to the south, and an upland forested area to the east. A National Grid overhead power line traverses the northern, eastern, and western boundaries.

Remediation at AOC 3 included capping the landfill and restoring the wetlands. Pan Am completed remediation activities, including wetland restoration and planting, in June 2019.

The newly restored wetlands at the Site are required to be monitored during Monitoring Years 1, 2, and 3 and then again during Monitoring Years 5, 7, and 10. Section 5 of the Plan outlines the requirements for long-term monitoring; success standards are summarized in Table 1. This report documents wetland monitoring field investigations and results for 2020 (Monitoring Year 2).

2. WETLAND CONSTRUCTION AND PERFORMANCE CRITERIA

Pan Am restored-in-place approximately 10,250 square feet of wetlands, permanently impacted 285 square feet of wetlands, and converted 35,580 square feet of upland into wetlands at AOC 3. Following final grading, native trees, shrubs, and emergent herbaceous vegetation were planted in specified locations to favor the development of palustrine emergent (PEM), scrub shrub (PSS), and palustrine forested wetlands (PFO) (Appendix A, Figure 2).

The Plan established five performance goals to evaluate the wetland restoration and creation (Table 1). Table 2 outlines the wetland monitoring schedule for the Site. This table pertains to AOCs 1, 2, 3, 5, and 6 within Operable Unit 3. As of 2020, monitoring has only been initiated at AOC 3.

Table 1: Wetland Mitigation Performance Goals

Category	Performance Goal
Vegetation Coverage: Areal coverage of non-invasive wetland plant species	75% cover within two full growing seasons (except deepwater marsh PEM wetlands in AOC 1)
Vegetation Richness: Number of volunteer native wetland species added per year	2 species added in Monitoring Years 2, 3 and 5 of post-construction monitoring
Hydrology Indicators ^a	Evidence of one primary indicator or two secondary indicators of hydrology in three of the first five years post-construction during the growing season
Tree Height: Increase in height of woody species each year with milestone goals	The average height of all woody stems of tree species including volunteers in each sampling plot, must increase by not less than an average of 10% per year by the fifth (Year 5 following construction) and tenth (Year 10 following construction) monitoring years. Trees shall be at least 5 feet or taller in total height after 10 years.

Category	Performance Goal
Survivability: Number of planted woody species that survive	80% of each of the approved planted woody species healthy and surviving in Year 5 of post-construction monitoring

^a Primary and secondary indicators used will be from the list in the most recent Regional Supplement to the Corps of Engineers Wetland Delineation Manual (USACE 2012).

Table 2: Wetland Mitigation Area Inspection and Monitoring Schedule for AOC 3

Monitoring Year	Spring Inspection	Summer Inspection	Areal Vegetation Coverage	Vegetation Richness	Hydrology Indicators	Tree Height	Woody Vegetation Survivability	Soil Evaluation	Agency Report
2019 (Monitoring Year 1)	Final Restoration	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
2020 (Monitoring Year 2)	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes
2021 (Monitoring Year 3)	Yes	Yes	No (If goal is met)	Yes	Yes	No	Yes	Yes	Yes
2022 (Monitoring Year 4)	No	No	No	No	No	No	No	No	No
2023 (Monitoring Year 5)	Yes	Yes	No (If goal is met)	Yes	Yes	Yes	Yes	Yes	Yes
2024 (Monitoring Year 6)	No	No	No	No	No	No	No	No	No
2025 (Monitoring Year 7)	Yes	Yes	No (If goal is met)	No (If goal is met)	No (If goal is met)	Yes	No (If goal is met)	No	Yes
2026 (Monitoring Year 8)	No	No	No	No	No	No	No	No	No
2027 (Monitoring Year 9)	No	No	No	No	No	No	No	No	No
2028 (Monitoring Year 10)	Yes	Yes	No (If goal is met)	No (If goal is met)	No (If goal is met)	Yes	No (If goal is met)	No	Yes

3. WETLAND MONITORING METHODOLOGY, RESULTS, AND CORRECTIVE ACTIONS

As described in Section 5 of the Plan, wetland areas must be inspected at least two times during the growing season in Monitoring Years 1, 2, 3, 5, 7, and 10 (ERM, 2012). ERM conducted the late spring 2020 monitoring event at AOC-3 on 2 June 2020. The late summer monitoring occurred on 18 and 23 September 2020. Monitoring activities included monitoring vegetation plots, analyzing vegetation coverage, documenting evidence of hydrology, walking the wetland mitigation area to create an ongoing list of species present, and quantifying tree survivability within the vegetation plots. Additional activities included photographing the Site from established photo stations, and identifying the location and density of invasive species.

3.1 Areal Vegetation Coverage

In 2019, ERM set up four long-term representative sampling plots within the wetland mitigation area of AOC 3. Each plot was marked with a permanent center stake. Due to the elongated shape of the mitigated wetland area, dimensions of each plot were modified to remain within the designated wetland type. All plots maintained an equivalent area to the 15-foot and 30-foot plot radiuses in accordance with the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region* (USACE, 2012). These same plots were used during the 2020 monitoring events and will be continue to be used in future monitoring. The forms used to record the vegetation coverage, as well as evidence of hydrology, are typically used to conduct a formal wetland delineation in accordance with the U.S. Army Corps of Engineers requirements. However, a formal delineation was not conducted, and the forms were used merely for their convenience to record vegetation observations and evidence of hydrology for the monitoring event.

Two of the plots (2A and 2D) are within the restored PEM wetland, plot 2B is in the PSS wetland, and plot 2C is in the PFO wetland. A summary of the total areal coverage by non-invasive wetland species per plot is provided in Tables 3 and 4. However, one particular species requires additional confirmation. The species identified during the 2019 Wetland Report as common barnyard grass (*Echinochloa crus-galli*) is often seen as an early colonizer of recently constructed wetlands. But it typically will die off in subsequent growing seasons as it has an indicator status of facultative (FAC) and often can't tolerate sustained wetness. Since this species returned and continues to be a dominant species in AOC 3, additional species identification is required to determine if the species in question is *Echinochloa crus-galli* or if it's the closely related and native American barnyard grass (*Echinochloa muricata*), which has an indicator status of facultative wetland (FACW) and can tolerate wetter conditions. If it is the native species, three of the four plots would meet the areal coverage performance goal (Table 3). If it is the non-native and invasive barnyard grass, then none of the four plots would meet the performance based on the 2020 data (Table 4).

In addition to the dominance of barnyard grass, the high water level in the wetlands, presumably due at least in part to the beaver (*Castor canadensis*) dam (see more description of the beaver activity in Section 3.3), has also impacted the amount of vegetation coverage in between the hummocks.

Table 3: 2020 Areal Coverage by Native Wetland Vegetation by Sampling Plot, Assuming American Barnyard Grass (*Echinochloa muricata*)

Wetland Mitigation Area	Vegetation Sampling Plot	Trees (%)	Shrubs/ Saplings(%)	Herbs (%)	Vines (%)	Absolute Cover (%) ¹	75% Goal Met
PEM	2A	0	2	81.5	0	83.5	Yes
PSS	2B	0	0.5	88	0	88.5	Yes
PFO	2C	0	1	76	0	77	No
PEM	2D	1	0	64	0	65	No

PEM = palustrine emergent; PFO = palustrine forested; PSS = scrub shrub

¹ Absolute cover of non-invasive wetlands species.

Table 4: 2020 Areal Coverage by Native Wetland Vegetation by Sampling Plot, Assuming Non-native Common Barnyard Grass (*Echinochloa crus-galli*)

Wetland Mitigation Area	Vegetation Sampling Plot	Trees (%)	Shrubs/ Saplings(%)	Herbs (%)	Vines (%)	Absolute Cover (%) ¹	75% Goal Met
PEM	2A	0	2	1.5	0	3.5	No
PSS	2B	0	0.5	23	0	23.5	No
PFO	2C	0	1	26	0	27	No
PEM	2D	1	0	24	0	25	No

PEM = palustrine emergent; PFO = palustrine forested; PSS = scrub shrub

¹ Absolute cover of non-invasive wetlands species.

3.1.1 Corrective Actions

If the barnyard grass dominant at the Site is definitely identified in 2021 as the native *Echinochloa muricata*, then no corrective actions will be taken to reduce the population in AOC 3 wetlands. If it is identified as the invasive *Echinochloa crus-galli*, then corrective actions will be identified to reduce the dominance of this species and increase the coverage of non-invasive wetland species to meet this performance goal. Possible corrective actions could include herbicide treatment of the barnyard grass, re-seeding the area with a native wetland seed mix, and/or planting additional wetland plugs of species anticipated to tolerate the amount of inundation observed within the AOC 3 wetlands.

3.2 Vegetation Richness

Vegetation richness refers to the number of native facultative (FAC), facultative-wet (FACW), or obligate (OBL) native plant species in the wetland. Volunteer species are those that were not planted or seeded, but colonized the area as part of natural revegetation. The Site meets the performance goal if at least two new native wetland plant species are observed in the wetlands in monitoring Years 2, 3 and 5.

In 2020, ERM scientists conducted meander surveys within the wetland mitigation area to identify additional plant species. ERM identified eight new plant species, six of which were FACW or OBL (Table 5). Four of these species, small-spiked false nettle (*Boehmeria cylindrical*), cursed crowfoot (*Ranunculus sceleratus*), New England aster (*Symphotrichum novae-angliae*) and common boneset (*Eupatorium perfoliatum*), are considered volunteer species, while the remaining two wetland species were included in

the seed mix. With six new non-invasive wetland plant species identified in 2020, this performance goal was met for the Year 2 milestone established.

Table 5: Comprehensive List of Vegetative Species Observed in the Wetland Areas of AOC 3 (Year 2)

Scientific Name	Common Name	Wetland Indicator Status ^{a, b}	Origin	Year first Identified
<i>Acer negundo</i>	boxelder	FAC	Planned	2019
<i>Acer rubrum</i>	red maple	FAC	Planned	2019
<i>Alnus incana</i>	speckled alder	FACW	Planned	2019
<i>Asclepias incarnata</i>	swamp milkweed	OBL	Planned	2020
<i>Bidens frondosa</i>	devil's beggar-ticks	FACW	Planned	2019
<i>Bidens cernua</i>	nodding beggar-ticks	OBL	Volunteer	2019
<i>Boehmeria cylindrica</i>	small-spiked false nettle	OBL	Volunteer	2020
<i>Cyperus esculentus</i>	yellow nutsedge	FACW	Volunteer	2019
<i>Echinochloa crus-galli</i>	large barnyard grass ^d	FAC	Volunteer	2019
<i>Eleocharis obtusa</i>	blunt spikesedge	OBL	Volunteer	2019
<i>Erechtites hieraciifolius</i>	American burnweed	FACU	Volunteer	2020
<i>Eupatorium perfoliatum</i>	common boneset	FACW	Volunteer	2020
<i>Glyceria striata</i>	fowl manna grass	OBL	Volunteer	2019
<i>Ipomoea hederacea</i>	ivy-leaved morning-glory ^d	FAC	Volunteer	2019
<i>Juncus effusus</i>	common softrush	OBL	Planned	2019
<i>Lemna minor</i>	common duckweed	OBL	Volunteer	2019
<i>Lythrum salicaria</i>	purple loosestrife ^c	OBL	Volunteer	2019
<i>Oenothera biennis</i>	common evening-primrose	FACU	Volunteer	2020
<i>Panicum spp.</i>	panic grass	FACW	Volunteer	2019
<i>Persicaria lapathifolia</i>	dock-leaf smartweed	FACW	Volunteer	2019
<i>Phragmites australis</i>	common reed ^c	FACW	Volunteer	2019
<i>Pontederia cordata</i>	pickerelweed	OBL	Planned	2019
<i>Robinia pseudoacacia</i>	black locust ^c	FACU	Volunteer	2019
<i>Ranunculus sceleratus</i>	cursed crowfoot	OBL	Volunteer	2020
<i>Salix nigra</i>	black willow	OBL	Planned	2019
<i>Sambucus nigra</i>	black elderberry	FACW	Planned	2019
<i>Schoenoplectus tabernaemontani</i>	softstem bulrush	OBL	Volunteer	2019
<i>Setaria faberi</i>	chinese foxtail ^d	FACU	Volunteer	2019
<i>Setaria pumila</i>	yellow bristle grass ^d	FAC	Volunteer	2019
<i>Symphyotrichum novae-angliae</i>	New England aster	FACW	Volunteer	2020
<i>Typha latifolia</i>	broadleaved cattail	OBL	Volunteer	2019

Scientific Name	Common Name	Wetland Indicator Status ^{a, b}	Origin	Year first Identified
<i>Vernonia noveboracensis</i>	New York ironweed	FACW	Planned	2020

^a FACU= Facultative-upland; FAC = facultative; FACW = facultative-wet; OBL = obligate

^b State of Massachusetts 2016 Wetland Plant List (USACE 2016)

^c Listed as an invasive plant species by the Massachusetts Invasive Plant Advisory Group (Massachusetts Invasive Plant Advisory Group 2005)

^d Non-native species (USDA 2019)

^e Bolded font indicates the species was first observed in 2020. Highlighted plants indicate species first observed in 2020, are FAC or wetter species and are used to determine performance goal progress.

3.3 Hydrology Indicators

Indicators of hydrology provide visual evidence of soil saturation and inundation necessary to support a functioning wetland. Each of the four wetland areas were investigated for the potential presence of primary or secondary hydrological indicators as defined in the Supplement (USACE, 2012). Despite drought conditions prevailing in 2020, all plots contained primary indicator A1, surface water, during the late summer and spring inspections. This indicator requires observation of flooding or ponding in the area (Supplement; USACE 2012). ERM observed the deepest surface water in plot 2A and measured depths of up to 12 inches. The results for each plot are documented on the forms provided in Appendix D. There was significantly more flooding observed in late summer 2020 than in 2019 or during the spring 2020 monitoring event. ERM determined the cause was a beaver dam that impounded the stream channel along the southern boundary of AOC-3A. Standing water in all plots contained floating algae mats as well as common duckweed. A summary of wetland hydrology indicators is provided in Table 6. ERM informed EPA of the beaver dam after the inspection to coordinate its removal to prevent further flooding or ponding within AOC 3. Upon a site inspection with EPA's consultant, AECOM, in November 2, 2020, the beaver dam was observed to have been removed. It was not removed as part of the Site activities.

Table 6: Wetland Hydrology Indicators by Sampling Plot Late Summer 2020

Plot	Hydrological Indicator
2A	Surface water (A1), Saturation (A3), Water Marks (B1)
2B	Surface water (A1), Saturation (A3), Algal Mat or Crust (B4)
2C	Surface water (A1), Saturation (A3), Water Marks (B1)
2D	Surface water (A1), Saturation (A3), Algal Mat or Crust (B4)

Based on the observation of sufficient hydrology in both years 2019 (Year 1) and 2020 (Year 2), this hydrology performance goal is on a trajectory towards being met if sufficient hydrology is observed during at least one more growing season prior to, or in, 2023.

3.4 Survivability and Tree Heights

Survivability refers to the number of planted woody species that survive. As described in the Plan, the survivability performance goal requires that at least 80 percent of the approved planted woody species survive at Year 5 of post-construction monitoring. To determine survivability, the Plan requires ERM to count the number of native planted woody species and volunteer woody species in the long-term monitoring plots. In addition, the Plan also requires the total tree height be measured during the first, fifth, seventh, and tenth years of monitoring within the established permanent sampling plot. The average height of all woody stems of tree species must increase at least 10 percent annually by the fifth (Year 5

following construction) and tenth (Year 10 following construction) monitoring years. Tree heights were not required to be measured in 2020; however, the survivability goal results and potential corrective actions will also influence the tracking of tree heights.

As reported in the 2019 Wetland Report, ERM located and counted planted trees and shrubs in the long-term monitoring plots in 2019 to establish the baseline against which future years would be compared (Table 7). Plantings were located in plot 2A, plot 2B and plot 2C. Plot 2D is located in the PEM wetland and did not contain any planted trees or shrubs, however Plot 2D does contain an overhanging red maple branch from the adjacent forest. This affected the areal coverage of the plot, but since the tree is outside of the constructed wetland, no tree layer is considered present.. While a survivability assessment was not required in 2020, ERM wetland scientists documented the status of the woody plantings within each of the plots to determine if they were on a trajectory towards meeting the goal. Out of 36 trees observed in the long term monitoring plots in 2019, 33 percent (12) were determined to have survived in 2020 (Table 7). Significant damage from beaver foraging and dam building resulted in mortality of planted woody species throughout AOC 3. Many of the woody plants were observed to be completely felled and removed by the beavers, while others sustained girdling damage. ERM found the remains of several of the planted trees used as part of construction of the nearby beaver dam. Plot 2A had the highest survivability, which was calculated to be 80 percent. This was despite the inundation that resulted from the beaver dam. No direct beaver damage was observed in Plot 2A. Plot 2B was observed to have missing woody shrubs, possibly due to the beaver activity. Plot 2C sustained the most notable beaver damage with 13 trees not surviving. Many of these trees were completely removed or girdled. Gnaw markings on the bark and the cut patterns were characteristic of beaver activity.

Table 7: Survivability of Native Woody Species within the Long-Term Monitoring Plots

Scientific Name	Common Name	Indicator Status	Design	2019 Baseline ^a	Number Observed Healthy in 2020	2020 Survivability ^b
Plot 2A						
<i>Alnus incana</i>	Speckled alder	FACW	Planted	5	4	80%
Plot 2A Sub Total						80%
Plot 2B						
<i>Alnus incana</i>	Speckled alder	FACW	Planted	6	0	0%
<i>Sambucus nigra</i>	Black elderberry	FACW	Planted	4	1	25%
<i>Viburnum dentatum</i>	Arrowwood	FAC	Planted	1	0	0%
Plot 2B Sub Total						9.1%
Plot 2C						
<i>Acer rubrum</i>	Red maple	FAC	Planted	3	0	0%
<i>Acer negundo</i>	Boxelder	FAC	Planted	11	5	45%
Unknown ^c	Unknown	Unknown	Unknown	1	0	0%
<i>Salix nigra</i>	Black willow	OBL	Planted	5	2	40%

Plot 2C Sub Total			35%
Overall	36	12	33% ^a

^a Numbers originally located in plot were identified in 2019 as a baseline. Survivability in 2020 was calculated based on 2019 baseline.

^b Weighted Average

^c This unknown plant was identified in 2019 and was confirmed to have been planted during restoration activities based on the presence of a biodegradable weed barrier that encircles the base. A biodegradable weed barrier was placed around all planted woody species. The plant was too weathered to make a confident identification. However, since it was confirmed to be planted, it was necessary to include it for the calculation of overall survivability.

FAC = facultative; FACW = facultative-wet; OBL = obligate

3.4.1 Corrective Actions

To help the constructed wetlands achieve the first survivability goal in Year 5 (2023), the water elevations and beaver activity will continue to be observed in AOC 3 during 2021. In the event that beaver activity resumes, and additional trees and shrubs are damaged or killed by the beavers, then several options for action will be discussed with EPA, including proper removal of the beavers (that have not been observed on this site for at least a decade), installation of a beaver deceiver (or similar device) to avoid the construction of another dam that will cause prolonged flooding in the AOC 3 wetlands, and/or installation of protection devices such as fencing or caging around surviving plants. Once the water elevations have stabilized or are better understood based on beaver activity, a re-planting event will be planned. Planting would not occur without a more complete understanding of the influence of the beaver activity on the water elevations since water elevations will dictate the species selected for the re-planting event. As of the writing of this report, re-planting is anticipated to occur in spring 2022, after detailed observations and possibly beaver control measures are implemented in calendar year 2021.

Periodic site visits will be scheduled in the first half of 2021 to observe water elevations and beaver activity in the wetlands within AOC 3. A summary of findings and recommended corrective actions is anticipated to be provided to EPA in early summer 2021.

3.5 Photographic Stations

During both the spring and late summer 2020 inspections, ERM revisited each of the photographic stations established in 2019 and took photographs in the same directions as taken in 2019. The 2020 late spring photographic log is included in Appendix B and late summer photographic log is included in Appendix C. Photographs from 2020 show the progression of the wetland as it matures, with new species evident in the photographs, and documentation of the various microhabitats present across the AOC 3 wetlands.

3.6 Invasive Species

As described in the Plan, the risk of colonization of invasive species is high, particularly purple loosestrife (*Lythrum salicaria*) and common reed (*Phragmites australis*). During the late spring 2020 monitoring event, ERM observed common reed, purple loosestrife, black locust (*Robinia pseudoacacia*), multiflora rose (*Rosa multiflora*), and glossy buckthorn (*Frangula alnus*). Scattered, loose colonies of purple loosestrife were observed in the vicinity of plot 2B, and south of Photo Station 2. A colony of common reed (30-40 stems) was located in the central portion of the site. In upland areas outside the wetland along the southern berm, ERM observed multiflora rose and glossy buckthorn. These two species were located outside the wetland. In the surrounding areas east of the Site, large concentrations of common

reed are still present. The berm appears to still function as a barrier, reducing the spread of common reed into the restored wetland.

To control the extent of invasive species, ERM supervised an herbicide treatments/application performed by SWCA Environmental Consultants (SWCA) on 31 August 2020. Two SWCA technicians, equipped with backpack sprayers, spot-treated the invasive species observed within the constructed wetlands in AOC 3. In total, SWCA applied 7 gallons of mixed herbicide solution.

3.6.1 Corrective Actions

During the 2020 late summer monitoring event, the extent of invasive plants was greatly reduced from observations noted in spring 2020. However, due to the high risk of colonization of invasive species in AOC 3, ERM recommends an herbicide application in summer 2021 to prevent invasive species from out-competing native species.

4. CONCLUSION

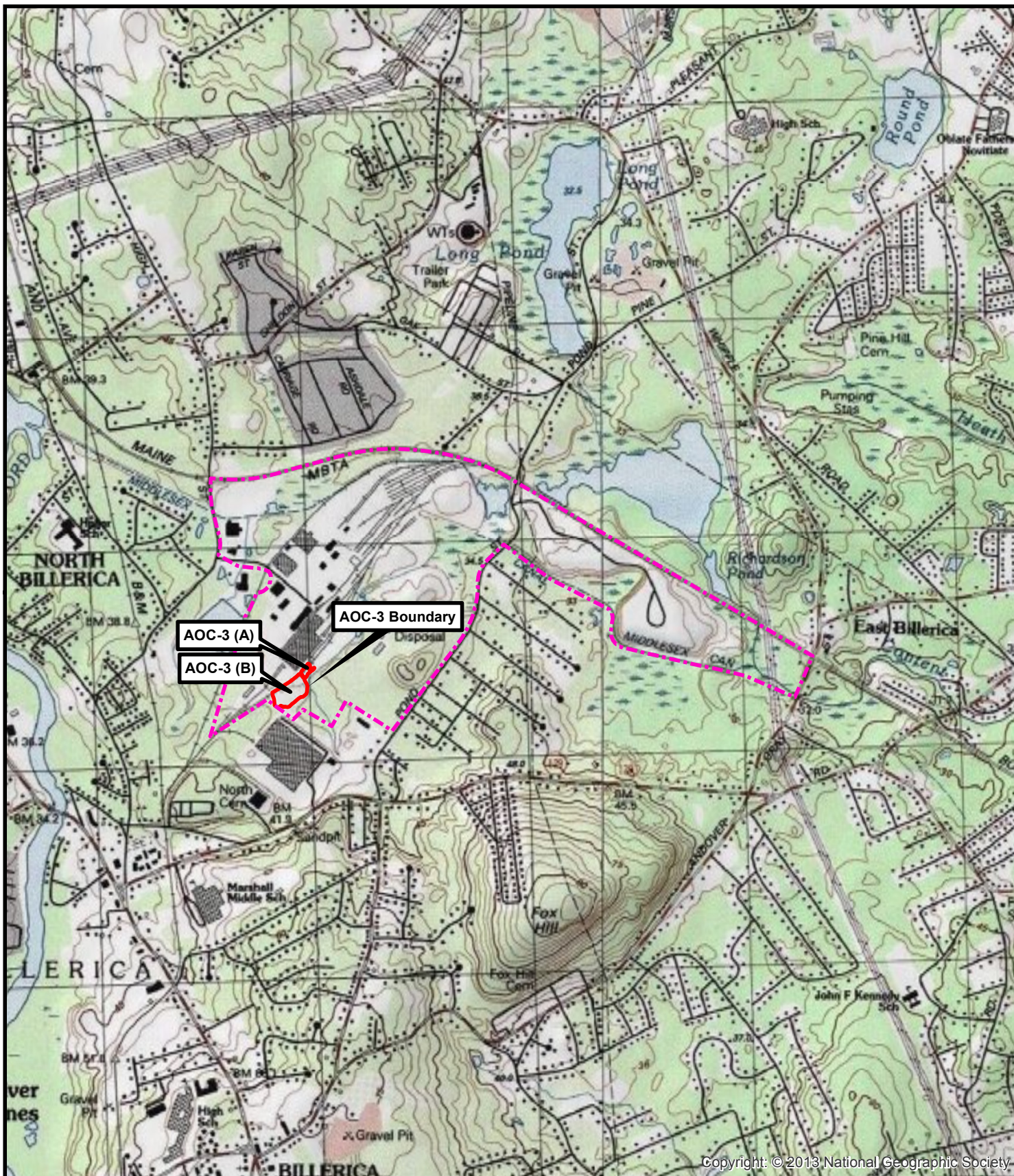
ERM conducted Year 2 Site monitoring in 2020 at AOC 3, and two of the five wetland mitigation performance goals are on track to being met: vegetation richness and hydrological indicators. In the event that the *Echinochloa* species is definitively identified as the native *Echinochloa muricata*, then the 75% areal coverage goal would be met as of 2020. If the species is still dominating the landscape in AOC 3 and is confirmed to be the invasive *Echinochloa crus-galli*, then additional corrective actions will be proposed to help achieve the areal coverage performance goal. Due to the uncertainty around the anticipated water levels in the AOC 3 wetlands, beaver activity will also be observed during 2021 to determine whether actions are required to stabilize water elevations.

Monitoring will continue in 2021 (Monitoring Year 3).

5. REFERENCES

- ERM. 2012. *Wetland Restoration and Creation Plant; Iron Horse Park Superfund Site Operable Unit 3, Billerica Massachusetts*.
- Massachusetts Invasive Plant Advisory Group. 2005. *The Evaluation of Non-Native Plant Species for Invasiveness in Massachusetts (with annotated list)*. Available online at https://www.massnrc.org/mipag/docs/MIPAG_FINDINGS_FINAL_042005.pdf. Accessed October 2019.
- U.S. Army Corps of Engineers (USACE). 2012. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region* (version 2.0), ed. J. S. Wakeley, R. W. Lichvar, C. V. Noble, and J. F. Berkowitz. ERDC/EL TR-12-1. Vicksburg, MS: U.S. Army Engineer Research and Development Center.
- U.S. Army Corps of Engineers (USACE). 2016. *State of Massachusetts 2016 Wetland Plant List*. Available online at: http://wetland-plants.usace.army.mil/nwpl_static/data/DOC/lists_2016/States/pdf/MA_2016v1.pdf. Accessed October 2019.
- U.S. Environmental Protection Agency (USEPA). 2018. *Fifth Five-Year Review Report For Iron Horse Park Superfund Site Operable Units 1, 2, 3, and 4. North Billerica, Massachusetts*. Available online at: <https://semspub.epa.gov/work/01/625446.pdf>. Accessed October 2019.
- U.S. Department of Agriculture, Natural Resource Conservation Science. 2019. *The PLANTS Database*. National Plant Data Team, Greensboro, NC 27401-4901 USA. Available online at: <http://plants.usda.gov>. Accessed 1 November 2019.

APPENDIX A FIGURES



Copyright: © 2013 National Geographic Society

Legend

- Iron Horse Park Site Boundary
- AOC-3 Boundary



0 0.1 0.2 0.3 0.4 0.5 0.6
Miles

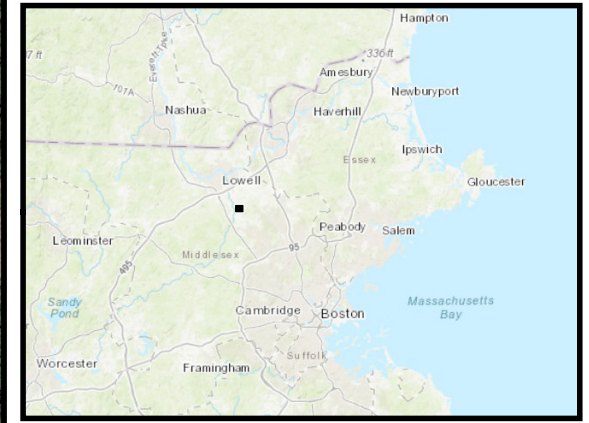
1:24,000

SOURCES:

USGS Topographic Quad Images (December 1995, June 2001) provided by ESRI ArcGIS Online and data partners including USGS and © 2007 National Geographic Society

Figure 1 - Site Locus Map
Iron Horse Park Superfund Site
Billerica, Massachusetts





- Legend**
- Photo Stations
 - Long Term Wetland Sample Plots
 - Palustrine Forested Wetland (PFO)
 - Palustrine Emergent Wetland (PEM)
 - Palustrine Scrub Shrub (PSS)
 - AOC-3 Boundary

NOTES:
 1. Aerial Imagery: Google Earth Imagery from 6/22/2019

Figure 2 - Wetland Monitoring
 Iron Horse Park Superfund Site
 Billerica, Massachusetts
 October 2019



APPENDIX B PHOTOGRAPHIC LOG



Photo Station 1 Facing Northeast



Photo Station 1 Facing South



Spring Wetland Monitoring Site Photographs

Monitoring Year 2020



Photo Station 2 Facing North



Photo Station 2 Facing East



Spring Wetland Monitoring Site Photographs Monitoring Year 2020



Photo Station 2 Facing South



Photo Station 3 Facing East



Spring Wetland Monitoring Site Photographs

Monitoring Year 2020



Photo Station 3 Facing Southeast



Photo Station 3 Facing Southwest



Spring Wetland Monitoring Site Photographs Monitoring Year 2020



Photo Station 4 Facing Northeast



Photo Station 5 Facing North



Spring Wetland Monitoring Site Photographs Monitoring Year 2020



Photo Station 5 Facing East



Photo Station 5 Facing Southeast



Spring Wetland Monitoring Site Photographs Monitoring Year 2020



Photo Station 6 Facing North



Photo Station 6 Facing South



Spring Wetland Monitoring Site Photographs Monitoring Year 2020



Photo Station 6 Facing West



Photo Station 7 Facing Southwest



Spring Wetland Monitoring Site Photographs

Monitoring Year 2020



Photo Station 7 Facing West



Spring Wetland Monitoring Site Photographs
Monitoring Year 2020

APPENDIX C LATE SUMMER PHOTOGRAPHIC LOG



Photo Station 1 Facing East



Photo Station 1 Facing Southeast



Late Summer Wetland Monitoring Site Photographs Monitoring Year 2020



Photo Station 2 Facing North



Photo Station 2 Facing East



Late Summer Wetland Monitoring Site Photographs Monitoring Year 2020



Photo Station 2 Facing South



Photo Station 3 Facing East



Late Summer Wetland Monitoring Site Photographs Monitoring Year 2020



Photo Station 3 Facing Southeast



Photo Station 3 Facing Southwest



Late Summer Wetland Monitoring Site Photographs

Monitoring Year 2020



Photo Station 4 Facing East



Photo Station 5 Facing Northeast



Late Summer Wetland Monitoring Site Photographs Monitoring Year 2020



Photo Station 5 Facing East



Photo Station 5 Facing Southeast



Late Summer Wetland Monitoring Site Photographs
Monitoring Year 2020



Photo Station 6 Facing North



Photo Station 6 Facing South



Late Summer Wetland Monitoring Site Photographs

Monitoring Year 2020



Photo Station 6 Facing West

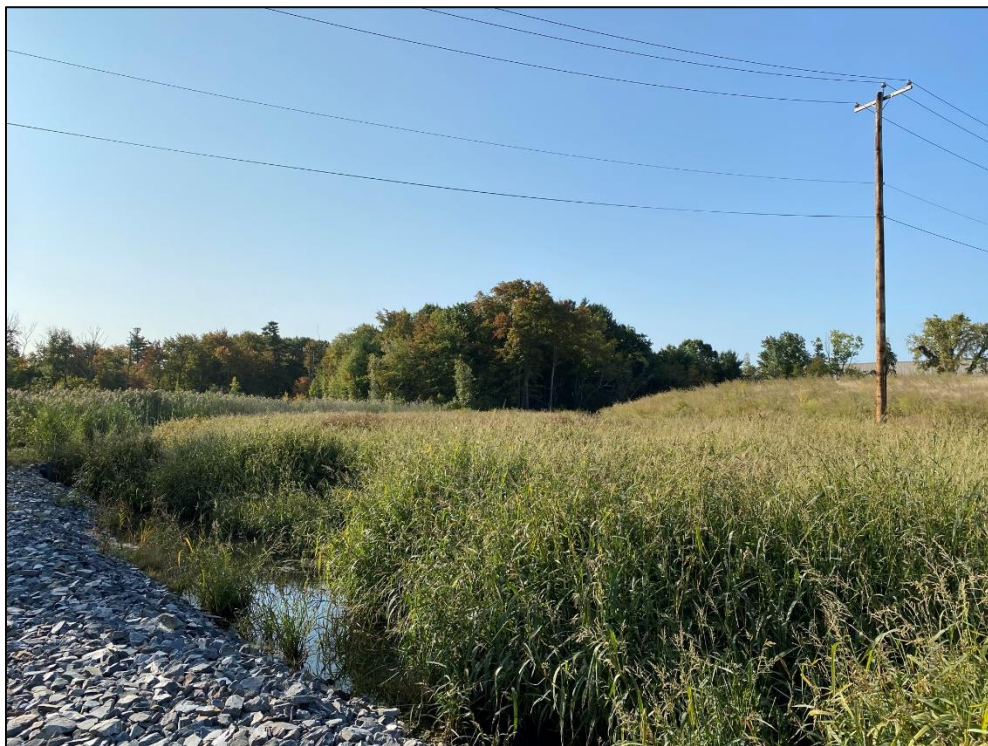


Photo Station 7 Facing Southwest



Late Summer Wetland Monitoring Site Photographs
Monitoring Year 2020



Photo Station 7 Facing West



Late Summer Wetland Monitoring Site Photographs
Monitoring Year 2020

APPENDIX D WETLAND DATASHEETS

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Iron Horse Park (AOC-3) City/County: Billerica, Middlesex County Sampling Date: 9/23/2020
 Applicant/Owner: Pan Am Railways State: MA Sampling Point: 2A
 Investigator(s): Evan Ehrlich, Hannah Buckley Section, Township, Range: _____
 Landform (hillslope, terrace, etc.): Drainage Local relief (concave, convex, none): Concave Slope (%): 0
 Subregion (LRR or MLRA): LRR R Lat: 42.57968 Long: -71.266414 Datum: Decimal Degrees
 Soil Map Unit Name: Freetown Muck 0 to 1 percent Slope NWI classification: PEM (Designed: PEM)

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
 Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes _____ No X
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <u>X</u> No _____	Is the Sampled Area within a Wetland? Yes <u>X</u> No _____ If yes, optional Wetland Site ID: _____
Hydric Soil Present? Yes _____ No _____	
Wetland Hydrology Present? Yes <u>X</u> No _____	
Remarks: (Explain alternative procedures here or in a separate report.) Higher than average surface water due to beaver activity. The site consists of wetland and upland areas that were constructed as part of remediation of a landfill. The restoration was completed in June 2019. The year 2020 is considered Monitoring Year 2.	

HYDROLOGY

Wetland Hydrology Indicators: <u>Primary Indicators</u> (minimum of one is required; check all that apply)		<u>Secondary Indicators</u> (minimum of two required)
<input checked="" type="checkbox"/> Surface Water (A1) <input type="checkbox"/> High Water Table (A2) <input checked="" type="checkbox"/> Saturation (A3) <input type="checkbox"/> Water Marks (B1) <input type="checkbox"/> Sediment Deposits (B2) <input type="checkbox"/> Drift Deposits (B3) <input checked="" type="checkbox"/> Algal Mat or Crust (B4) <input type="checkbox"/> Iron Deposits (B5) <input type="checkbox"/> Inundation Visible on Aerial Imagery (B7) <input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Water-Stained Leaves (B9) <input type="checkbox"/> Aquatic Fauna (B13) <input type="checkbox"/> Marl Deposits (B15) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3) <input type="checkbox"/> Presence of Reduced Iron (C4) <input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6) <input type="checkbox"/> Thin Muck Surface (C7) <input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Surface Soil Cracks (B6) <input type="checkbox"/> Drainage Patterns (B10) <input type="checkbox"/> Moss Trim Lines (B16) <input type="checkbox"/> Dry-Season Water Table (C2) <input type="checkbox"/> Crayfish Burrows (C8) <input type="checkbox"/> Saturation Visible on Aerial Imagery (C9) <input type="checkbox"/> Stunted or Stressed Plants (D1) <input type="checkbox"/> Geomorphic Position (D2) <input type="checkbox"/> Shallow Aquitard (D3) <input type="checkbox"/> Microtopographic Relief (D4) <input type="checkbox"/> FAC-Neutral Test (D5)
Field Observations: Surface Water Present? Yes <u>X</u> No _____ Depth (inches): <u>12 inches</u> Water Table Present? Yes _____ No _____ Depth (inches): <u>n/a</u> Saturation Present? Yes _____ No _____ Depth (inches): <u>n/a</u> (includes capillary fringe)		Wetland Hydrology Present? Yes <u>X</u> No _____
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:		
Remarks: Higher than average surface water due to beaver activity.		

VEGETATION – Use scientific names of plants.

 Sampling Point: 2A

Tree Stratum (Plot size: <u>12x18x30x60ft</u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u>None</u>				Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A) Total Number of Dominant Species Across All Strata: _____ (B) Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)
2. _____				
3. _____				
4. _____				
5. _____				
6. _____				
7. _____				
_____ = Total Cover				Prevalence Index worksheet: <div style="display: flex; justify-content: space-between;"> Total % Cover of: _____ Multiply by: _____ </div> OBL species _____ x 1 = _____ FACW species _____ x 2 = _____ FAC species _____ x 3 = _____ FACU species _____ x 4 = _____ UPL species _____ x 5 = _____ Column Totals: _____ (A) _____ (B) Prevalence Index = B/A = _____
Sapling/Shrub Stratum (Plot size: <u>12'x18'x30'x60'</u>)				
1. <u>Speckled Alder (<i>Alnus incana</i>)</u>	<u>2</u>	<u>Yes</u>	<u>FACW</u>	
2. _____				
3. _____				
4. _____				
5. _____				
6. _____				
7. _____				
_____ = Total Cover				Hydrophytic Vegetation Indicators: ___ 1 - Rapid Test for Hydrophytic Vegetation ___ 2 - Dominance Test is >50% ___ 3 - Prevalence Index is ≤3.0 ¹ ___ 4 - Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) ___ Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
Herb Stratum (Plot size: <u>12'x15'x15'x18'</u>)				
1. <u>Barnyard Grass (<i>Echinochloa crus-galli</i>)</u>	<u>80</u>	<u>Yes</u>	<u>FAC</u>	
2. <u>Pickerelweed (<i>Pontederia cordata</i>)</u>	<u>1</u>	<u>No</u>	<u>OBL</u>	
3. <u>Common Duckweed (<i>Lemna minor</i>)</u>	<u>0.5</u>	<u>No</u>	<u>OBL</u>	
4. _____				
5. _____				
6. _____				
7. _____				
8. _____				
9. _____				
10. _____				
11. _____				
12. _____				
_____ = Total Cover				Definitions of Vegetation Strata: Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height. Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall. Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall. Woody vines – All woody vines greater than 3.28 ft in height.
Woody Vine Stratum (Plot size: _____)				
1. _____				
2. _____				
3. _____				
4. _____				
_____ = Total Cover				
Hydrophytic Vegetation Present? Yes _____ No _____				
Remarks: (Include photo numbers here or on a separate sheet.) Woody Vegetation: Species Status Speckled alder Survived Speckled alder Survived Speckled alder Survived Speckled alder Survived Speckled alder Not Survived No Browsing damage observed				

SOIL

Sampling Point: 2A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

[illegible]¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)	___ Polyvalue Below Surface (S8) (LRR R,
___ Histic Epipedon (A2)	MLRA 149B)
___ Black Histic (A3)	___ Thin Dark Surface (S9) (LRR R, MLRA 149B)
___ Hydrogen Sulfide (A4)	___ Loamy Mucky Mineral (F1) (LRR K, L)
___ Stratified Layers (A5)	___ Loamy Gleyed Matrix (F2)
___ Depleted Below Dark Surface (A11)	___ Depleted Matrix (F3)
___ Thick Dark Surface (A12)	___ Redox Dark Surface (F6)
___ Sandy Mucky Mineral (S1)	___ Depleted Dark Surface (F7)
___ Sandy Gleyed Matrix (S4)	___ Redox Depressions (F8)
___ Sandy Redox (S5)	
___ Stripped Matrix (S6)	
___ Dark Surface (S7) (LRR R, MLRA 149B)	

Indicators for Problematic Hydric Soils³:

☐ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
☐ Coast Prairie Redox (A16) (**LRR K, L, R**)
☐ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
☐ Dark Surface (S7) (**LRR K, L**)
☐ Polyvalue Below Surface (S8) (**LRR K, L**)
☐ Thin Dark Surface (S9) (**LRR K, L**)
☐ Iron-Manganese Masses (F12) (**LRR K, L, R**)
☐ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
☐ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
☐ Red Parent Material (F21)
☐ Very Shallow Dark Surface (TF12)
☐ Other (Explain in Remarks)

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No _____

Remarks:

Soils not observed during the second monitoring year (2020).

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Iron Horse Park (AOC-3) City/County: Billerica, Middlesex County Sampling Date: 9/18/2020
 Applicant/Owner: Pan Am Railways State: MA Sampling Point: 2B
 Investigator(s): Evan Ehrlich, Hannah Buckley Section, Township, Range: _____
 Landform (hillslope, terrace, etc.): Drainage Local relief (concave, convex, none): Concave Slope (%): 0
 Subregion (LRR or MLRA): LRR R Lat: 42.579444 Long: -71.266440 Datum: Decimal Degrees
 Soil Map Unit Name: Freetown Muck 0 to 1 percent Slope NWI classification: PEM (Design: PSS)

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No X (If no, explain in Remarks.)
 Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes _____ No X
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <u>X</u> No _____	Is the Sampled Area within a Wetland? Yes <u>X</u> No _____ If yes, optional Wetland Site ID: _____
Hydric Soil Present? Yes _____ No _____	
Wetland Hydrology Present? Yes <u>X</u> No _____	
Remarks: (Explain alternative procedures here or in a separate report.) Higher than average surface water due to beaver activity. The site consists of wetland and upland areas that were constructed as part of remediation of a landfill. The restoration was completed in June 2019. The year 2020 is considered Monitoring Year 2.	

HYDROLOGY

Wetland Hydrology Indicators: <u>Primary Indicators</u> (minimum of one is required; check all that apply)		<u>Secondary Indicators</u> (minimum of two required)
<input checked="" type="checkbox"/> Surface Water (A1) <input type="checkbox"/> High Water Table (A2) <input checked="" type="checkbox"/> Saturation (A3) <input type="checkbox"/> Water Marks (B1) <input type="checkbox"/> Sediment Deposits (B2) <input type="checkbox"/> Drift Deposits (B3) <input checked="" type="checkbox"/> Algal Mat or Crust (B4) <input type="checkbox"/> Iron Deposits (B5) <input type="checkbox"/> Inundation Visible on Aerial Imagery (B7) <input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Water-Stained Leaves (B9) <input type="checkbox"/> Aquatic Fauna (B13) <input type="checkbox"/> Marl Deposits (B15) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3) <input type="checkbox"/> Presence of Reduced Iron (C4) <input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6) <input type="checkbox"/> Thin Muck Surface (C7) <input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Surface Soil Cracks (B6) <input type="checkbox"/> Drainage Patterns (B10) <input type="checkbox"/> Moss Trim Lines (B16) <input type="checkbox"/> Dry-Season Water Table (C2) <input type="checkbox"/> Crayfish Burrows (C8) <input type="checkbox"/> Saturation Visible on Aerial Imagery (C9) <input type="checkbox"/> Stunted or Stressed Plants (D1) <input type="checkbox"/> Geomorphic Position (D2) <input type="checkbox"/> Shallow Aquitard (D3) <input type="checkbox"/> Microtopographic Relief (D4) <input type="checkbox"/> FAC-Neutral Test (D5)
Field Observations: Surface Water Present? Yes <u>X</u> No _____ Depth (inches): <u>2-4 inches</u> Water Table Present? Yes _____ No _____ Depth (inches): _____ Saturation Present? Yes _____ No _____ Depth (inches): _____ (includes capillary fringe)		Wetland Hydrology Present? Yes <u>X</u> No _____
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:		
Remarks:		

VEGETATION – Use scientific names of plants.

 Sampling Point: 2B

Tree Stratum (Plot size: <u>43x30x20x27</u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u>None</u>				Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A) Total Number of Dominant Species Across All Strata: _____ (B) Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)
2. _____				
3. _____				
4. _____				
5. _____				
6. _____				
7. _____				
_____ = Total Cover				Prevalence Index worksheet: <div style="display: flex; justify-content: space-between;"> Total % Cover of: _____ Multiply by: _____ </div> OBL species _____ x 1 = _____ FACW species _____ x 2 = _____ FAC species _____ x 3 = _____ FACU species _____ x 4 = _____ UPL species _____ x 5 = _____ Column Totals: _____ (A) _____ (B) Prevalence Index = B/A = _____
Sapling/Shrub Stratum (Plot size: <u>43x30x20x27</u>)				
1. <u>Black elderberry (<i>Sambucus nigra</i>)</u>	<u>0.5</u>	<u>Yes</u>	<u>FACW</u>	
2. _____				
3. _____				
4. _____				
5. _____				
_____ = Total Cover				
Herb Stratum (Plot size: _____)				Hydrophytic Vegetation Indicators: ___ 1 - Rapid Test for Hydrophytic Vegetation ___ 2 - Dominance Test is >50% ___ 3 - Prevalence Index is ≤3.0 ¹ ___ 4 - Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) ___ Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
1. <u>Barnyard Grass (<i>Echinochloa colona</i>)</u>	<u>65</u>	<u>Yes</u>	<u>FACW</u>	
2. <u>Broadleaved Cattail (<i>Typha latifolia</i>)</u>	<u>10</u>	<u>No</u>	<u>OBL</u>	
3. <u>Nodding Beggars Tick (<i>Bidens cernua</i>)</u>	<u>10</u>	<u>No</u>	<u>OBL</u>	
4. <u>American burnweed (<i>Erechtites hieraciifolius</i>)</u>	<u>5</u>	<u>No</u>	<u>FACU</u>	
5. <u>Dock-leaved smartweed (<i>Persicaria lapathifolia</i>)</u>	<u>5</u>	<u>No</u>	<u>FACW</u>	
6. <u>Common evening-primrose (<i>Oenothera biennis</i>)</u>	<u>1</u>	<u>No</u>	<u>FACU</u>	
7. <u>Common soft rush (<i>Juncus effusus</i>)</u>	<u>1</u>	<u>No</u>	<u>OBL</u>	Definitions of Vegetation Strata: Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height. Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall. Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall. Woody vines – All woody vines greater than 3.28 ft in height.
8. <u>Black locust (<i>Robinia pseudoacacia</i>)</u>	<u>1</u>	<u>No</u>	<u>FACU</u>	
9. <u>Common duckweed (<i>Lemna minor</i>)</u>	<u>1</u>	<u>No</u>	<u>OBL</u>	
10. <u>yellow bristle grass (<i>Setaria pumila</i>)</u>	<u>0.5</u>	<u>No</u>	<u>FAC</u>	
11. <u>Common reed (<i>Phragmites australis</i>)</u>	<u>0.5</u>	<u>No</u>	<u>FACW</u>	
12. _____				
_____ = Total Cover				
Woody Vine Stratum (Plot size: _____)				Hydrophytic Vegetation Present? Yes _____ No _____
1. _____				
2. _____				
3. _____				
4. _____				
_____ = Total Cover				
Remarks: (Include photo numbers here or on a separate sheet.) <div style="display: flex; justify-content: space-between;"> <div> Species Black elderberry </div> <div> Status Survived </div> </div>				

SOIL

Sampling Point: 2B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

[illegible]

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- | | |
|---|--|
| <input type="checkbox"/> Histosol (A1) | <input type="checkbox"/> Polyvalue Below Surface (S8) (LRR R, |
| <input type="checkbox"/> Histic Epipedon (A2) | MLRA 149B) |
| <input type="checkbox"/> Black Histic (A3) | <input type="checkbox"/> Thin Dark Surface (S9) (LRR R, MLRA 149B) |
| <input type="checkbox"/> Hydrogen Sulfide (A4) | <input type="checkbox"/> Loamy Mucky Mineral (F1) (LRR K, L) |
| <input type="checkbox"/> Stratified Layers (A5) | <input type="checkbox"/> Loamy Gleyed Matrix (F2) |
| <input type="checkbox"/> Depleted Below Dark Surface (A11) | <input type="checkbox"/> Depleted Matrix (F3) |
| <input type="checkbox"/> Thick Dark Surface (A12) | <input type="checkbox"/> Redox Dark Surface (F6) |
| <input type="checkbox"/> Sandy Mucky Mineral (S1) | <input type="checkbox"/> Depleted Dark Surface (F7) |
| <input type="checkbox"/> Sandy Gleyed Matrix (S4) | <input type="checkbox"/> Redox Depressions (F8) |
| <input type="checkbox"/> Sandy Redox (S5) | |
| <input type="checkbox"/> Stripped Matrix (S6) | |
| <input type="checkbox"/> Dark Surface (S7) (LRR R, MLRA 149B) | |

Indicators for Problematic Hydric Soils³:

- ☐ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
☐ Coast Prairie Redox (A16) (**LRR K, L, R**)
☐ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
☐ Dark Surface (S7) (**LRR K, L**)
☐ Polyvalue Below Surface (S8) (**LRR K, L**)
☐ Thin Dark Surface (S9) (**LRR K, L**)
☐ Iron-Manganese Masses (F12) (**LRR K, L, R**)
☐ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
☐ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
☐ Red Parent Material (F21)
☐ Very Shallow Dark Surface (TF12)
☐ Other (Explain in Remarks)

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No _____

Remarks:

Soils not observed during the second monitoring year (2020).

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Iron Horse Park (AOC-3) City/County: Billerica, Middlesex County Sampling Date: 9/18/2020
 Applicant/Owner: Pan Am Railways State: MA Sampling Point: 2C
 Investigator(s): Evan Ehrlich, Hannah Buckley Section, Township, Range: _____
 Landform (hillslope, terrace, etc.): Drainage Local relief (concave, convex, none): Concave Slope (%): 0
 Subregion (LRR or MLRA): LLR R Lat: 42.578999 Long: -71.266241 Datum: Decimal Degrees
 Soil Map Unit Name: Freetown Muck 0 to 1 percent Slope NWI classification: PEM (Design: PFO)

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No X (If no, explain in Remarks.)
 Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes _____ No X
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <u>X</u> No _____	Is the Sampled Area within a Wetland? Yes <u>X</u> No _____ If yes, optional Wetland Site ID: _____
Hydric Soil Present? Yes _____ No _____	
Wetland Hydrology Present? Yes <u>X</u> No _____	
Remarks: (Explain alternative procedures here or in a separate report.) Higher than average surface water due to beaver activity. The site consists of wetland and upland areas that were constructed as part of remediation of a landfill. The restoration was completed in June 2019. The year 2020 is considered Monitoring Year 2.	

HYDROLOGY

Wetland Hydrology Indicators: <u>Primary Indicators</u> (minimum of one is required; check all that apply)		<u>Secondary Indicators</u> (minimum of two required)
<input checked="" type="checkbox"/> Surface Water (A1) <input type="checkbox"/> High Water Table (A2) <input checked="" type="checkbox"/> Saturation (A3) <input checked="" type="checkbox"/> Water Marks (B1) <input type="checkbox"/> Sediment Deposits (B2) <input type="checkbox"/> Drift Deposits (B3) <input type="checkbox"/> Algal Mat or Crust (B4) <input type="checkbox"/> Iron Deposits (B5) <input type="checkbox"/> Inundation Visible on Aerial Imagery (B7) <input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Water-Stained Leaves (B9) <input type="checkbox"/> Aquatic Fauna (B13) <input type="checkbox"/> Marl Deposits (B15) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3) <input type="checkbox"/> Presence of Reduced Iron (C4) <input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6) <input type="checkbox"/> Thin Muck Surface (C7) <input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Surface Soil Cracks (B6) <input type="checkbox"/> Drainage Patterns (B10) <input type="checkbox"/> Moss Trim Lines (B16) <input type="checkbox"/> Dry-Season Water Table (C2) <input type="checkbox"/> Crayfish Burrows (C8) <input type="checkbox"/> Saturation Visible on Aerial Imagery (C9) <input type="checkbox"/> Stunted or Stressed Plants (D1) <input type="checkbox"/> Geomorphic Position (D2) <input type="checkbox"/> Shallow Aquitard (D3) <input type="checkbox"/> Microtopographic Relief (D4) <input type="checkbox"/> FAC-Neutral Test (D5)
Field Observations: Surface Water Present? Yes <u>X</u> No _____ Depth (inches): <u>6 inches</u> Water Table Present? Yes _____ No _____ Depth (inches): _____ Saturation Present? Yes <u>X</u> No _____ Depth (inches): _____ (includes capillary fringe)		Wetland Hydrology Present? Yes <u>X</u> No _____
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:		
Remarks:		

VEGETATION – Use scientific names of plants.

Sampling Point: 2C

Tree Stratum (Plot size: <u>35x50x35x10</u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u>None</u>				Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A) Total Number of Dominant Species Across All Strata: _____ (B) Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)
2. _____				
3. _____				
4. _____				
5. _____				
6. _____				
7. _____				
_____ = Total Cover				Prevalence Index worksheet: <div style="display: flex; justify-content: space-between;"> Total % Cover of: _____ Multiply by: _____ </div> OBL species _____ x 1 = _____ FACW species _____ x 2 = _____ FAC species _____ x 3 = _____ FACU species _____ x 4 = _____ UPL species _____ x 5 = _____ Column Totals: _____ (A) _____ (B) Prevalence Index = B/A = _____
Sapling/Shrub Stratum (Plot size: <u>35x50x35x10</u>)				
1. <u>Box Elder (Acer negundo)</u>	<u>0.5</u>	<u>Yes</u>	<u>FAC</u>	
2. <u>Black Willow (Salix nigra)</u>	<u>0.5</u>	<u>Yes</u>	<u>OBL</u>	
3. _____				
4. _____				
5. _____				
6. _____				
7. _____				
_____ 1 _____ = Total Cover				Hydrophytic Vegetation Indicators: ___ 1 - Rapid Test for Hydrophytic Vegetation ___ 2 - Dominance Test is >50% ___ 3 - Prevalence Index is ≤3.0 ¹ ___ 4 - Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) ___ Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
Herb Stratum (Plot size: <u>15x20x15x10</u>)				
1. <u>barnyard grass (Echinochloa crus-galli)</u>	<u>50</u>	<u>Yes</u>	<u>FAC</u>	
2. <u>Dock leaved smartweed (Persicaria lapathifolia)</u>	<u>25</u>	<u>Yes</u>	<u>FACW</u>	
3. <u>Chinese foxtail (Setaria faberi)</u>	<u>5</u>	<u>No</u>	<u>FACW</u>	
4. <u>small-spiked false nettle (Boehmeria cylindrica)</u>	<u>1</u>	<u>No</u>	<u>OBL</u>	
5. _____				
6. _____				
7. _____				
8. _____				
9. _____				
10. _____				
11. _____				
12. _____				
_____ 81 _____ = Total Cover				Definitions of Vegetation Strata: Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height. Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall. Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall. Woody vines – All woody vines greater than 3.28 ft in height.
Woody Vine Stratum (Plot size: _____)				
1. _____				
2. _____				
3. _____				
4. _____				

_____ = Total Cover				Hydrophytic Vegetation Present? Yes _____ No _____
Remarks: (Include photo numbers here or on a separate sheet.) Significant beaver (Castor canadensis) activity, most plants particularly box elder (Acer negundo), black willow (Salix nigra) and red maple (Acer rubrum) were impacted. Entire stems were removed by the beaver and other stems were girdled.				

Species:	Status:	Species:	Status:
Box elder	Survived	Unknown	Not Survived
Black willow	Survived	Black willow	Not Survived
Box elder	Not Survived	Unknown	Not Survived
Box elder	Survived	Box elder	Survived
Unknown	Not Survived	Black Willow	Survived
Unknown	Not Survived	Box elder	Survived
Unknown	Not Survived	Unknown	Not Survived
Box Elder	Survived		

SOIL

Sampling Point: 2C

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

[illegible]¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Polyvalue Below Surface (S8) (LRR R,
<input type="checkbox"/> Histic Epipedon (A2)	MLRA 149B)
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Thin Dark Surface (S9) (LRR R, MLRA 149B)
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1) (LRR K, L)
<input type="checkbox"/> Stratified Layers (A5)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Depleted Matrix (F3)
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Redox Dark Surface (F6)
<input type="checkbox"/> Sandy Mucky Mineral (S1)	<input type="checkbox"/> Depleted Dark Surface (F7)
<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> Redox Depressions (F8)
<input type="checkbox"/> Sandy Redox (S5)	
<input type="checkbox"/> Stripped Matrix (S6)	
<input type="checkbox"/> Dark Surface (S7) (LRR R, MLRA 149B)	

Indicators for Problematic Hydric Soils³:

☐ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
☐ Coast Prairie Redox (A16) (**LRR K, L, R**)
☐ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
☐ Dark Surface (S7) (**LRR K, L**)
☐ Polyvalue Below Surface (S8) (**LRR K, L**)
☐ Thin Dark Surface (S9) (**LRR K, L**)
☐ Iron-Manganese Masses (F12) (**LRR K, L, R**)
☐ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
☐ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
☐ Red Parent Material (F21)
☐ Very Shallow Dark Surface (TF12)
☐ Other (Explain in Remarks)

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No _____

Remarks:

Soils not observed during the second monitoring year (2020).

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Iron Horse Park (AOC-3) City/County: Billerica, Middlesex County Sampling Date: 9/18/2020
 Applicant/Owner: Pan Am Railways State: MA Sampling Point: 2D
 Investigator(s): Evan Ehrlich, Hannah Buckley Section, Township, Range: _____
 Landform (hillslope, terrace, etc.): Drainage Local relief (concave, convex, none): Concave Slope (%): 0
 Subregion (LRR or MLRA): LRR R Lat: 42.578500 Long: -71.266596 Datum: Decimal Degrees
 Soil Map Unit Name: Freetown Muck 0 to 1 percent Slope NWI classification: PEM (Design: PEM)

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No X (If no, explain in Remarks.)
 Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes _____ No X
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <u>X</u> No _____	Is the Sampled Area within a Wetland? Yes <u>X</u> No _____ If yes, optional Wetland Site ID: _____
Hydric Soil Present? Yes _____ No _____	
Wetland Hydrology Present? Yes <u>X</u> No _____	
Remarks: (Explain alternative procedures here or in a separate report.) Higher than average surface water due to beaver activity. The site consists of wetland and upland areas that were constructed as part of remediation of a landfill. The restoration was completed in June 2019. The year 2020 is considered Monitoring Year 2.	

HYDROLOGY

Wetland Hydrology Indicators: <u>Primary Indicators (minimum of one is required; check all that apply)</u> <u>X</u> Surface Water (A1) _____ Water-Stained Leaves (B9) _____ High Water Table (A2) _____ Aquatic Fauna (B13) <u>X</u> Saturation (A3) _____ Marl Deposits (B15) <u>X</u> Water Marks (B1) _____ Hydrogen Sulfide Odor (C1) _____ Sediment Deposits (B2) _____ Oxidized Rhizospheres on Living Roots (C3) _____ Drift Deposits (B3) _____ Presence of Reduced Iron (C4) _____ Algal Mat or Crust (B4) _____ Recent Iron Reduction in Tilled Soils (C6) _____ Iron Deposits (B5) _____ Thin Muck Surface (C7) _____ Inundation Visible on Aerial Imagery (B7) _____ Other (Explain in Remarks) _____ Sparsely Vegetated Concave Surface (B8)		<u>Secondary Indicators (minimum of two required)</u> _____ Surface Soil Cracks (B6) _____ Drainage Patterns (B10) _____ Moss Trim Lines (B16) _____ Dry-Season Water Table (C2) _____ Crayfish Burrows (C8) _____ Saturation Visible on Aerial Imagery (C9) _____ Stunted or Stressed Plants (D1) _____ Geomorphic Position (D2) _____ Shallow Aquitard (D3) _____ Microtopographic Relief (D4) _____ FAC-Neutral Test (D5)
Field Observations: Surface Water Present? Yes <u>X</u> No _____ Depth (inches): <u>4 inches</u> Water Table Present? Yes _____ No _____ Depth (inches): _____ Saturation Present? Yes _____ No _____ Depth (inches): _____ (includes capillary fringe)		Wetland Hydrology Present? Yes <u>X</u> No _____
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:		
Remarks:		

VEGETATION – Use scientific names of plants.

 Sampling Point: 2D

Tree Stratum (Plot size: <u>35x30x55</u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u>Red maple (<i>Acer rubrum</i>)</u>	<u>1</u>	<u>Yes</u>	<u>FAC</u>	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A) Total Number of Dominant Species Across All Strata: _____ (B) Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)
2. <u>(Not planted, overhanging branch from adjacent forest.)</u>				
3. _____				
4. _____				
5. _____				
6. _____				
7. _____				
<u>1</u> = Total Cover				Prevalence Index worksheet: <div style="display: flex; justify-content: space-between;"> Total % Cover of: _____ Multiply by: _____ </div> OBL species _____ x 1 = _____ FACW species _____ x 2 = _____ FAC species _____ x 3 = _____ FACU species _____ x 4 = _____ UPL species _____ x 5 = _____ Column Totals: _____ (A) _____ (B) Prevalence Index = B/A = _____
Sapling/Shrub Stratum (Plot size: <u>35x30x55</u>)				
1. <u>(None)</u>				
2. _____				
3. _____				
4. _____				
5. _____				
_____ = Total Cover				
Herb Stratum (Plot size: <u>20x20x20</u>)				
1. <u>Barnyard grass (<i>Echinochloa crus-galli</i>)</u>	<u>40</u>	<u>Yes</u>	<u>FAC</u>	Hydrophytic Vegetation Indicators: <input type="checkbox"/> 1 - Rapid Test for Hydrophytic Vegetation <input type="checkbox"/> 2 - Dominance Test is >50% <input type="checkbox"/> 3 - Prevalence Index is ≤3.0 ¹ <input type="checkbox"/> 4 - Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
2. <u>Common duckweed (<i>Lemna minor</i>)</u>	<u>20</u>	<u>Yes</u>	<u>OBL</u>	
3. <u>Broadleaved cattail (<i>Typha latifolia</i>)</u>	<u>15</u>	<u>No</u>	<u>OBL</u>	
4. <u>Soft rush (<i>Juncus effusus</i>)</u>	<u>2</u>	<u>No</u>	<u>OBL</u>	
5. <u>Pickerselweed (<i>Pontederia cordata</i>)</u>	<u>1</u>	<u>No</u>	<u>OBL</u>	
6. <u>Devil's beggarticks (<i>Bidens frondosa</i>)</u>	<u>1</u>	<u>No</u>	<u>FACW</u>	
7. _____				
8. _____				
9. _____				
10. _____				
11. _____				
12. _____				
<u>79</u> = Total Cover				
Woody Vine Stratum (Plot size: _____)				
1. <u>None</u>				Definitions of Vegetation Strata: Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height. Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall. Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall. Woody vines – All woody vines greater than 3.28 ft in height.
2. _____				
3. _____				
4. _____				
_____ = Total Cover				Hydrophytic Vegetation Present? Yes _____ No _____
Remarks: (Include photo numbers here or on a separate sheet.) No planted trees within the PEM Wetland in 2D				

SOIL

Sampling Point: 2D

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

[illegible]¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)	___ Polyvalue Below Surface (S8) (LRR R,
___ Histic Epipedon (A2)	MLRA 149B)
___ Black Histic (A3)	___ Thin Dark Surface (S9) (LRR R, MLRA 149B)
___ Hydrogen Sulfide (A4)	___ Loamy Mucky Mineral (F1) (LRR K, L)
___ Stratified Layers (A5)	___ Loamy Gleyed Matrix (F2)
___ Depleted Below Dark Surface (A11)	___ Depleted Matrix (F3)
___ Thick Dark Surface (A12)	___ Redox Dark Surface (F6)
___ Sandy Mucky Mineral (S1)	___ Depleted Dark Surface (F7)
___ Sandy Gleyed Matrix (S4)	___ Redox Depressions (F8)
___ Sandy Redox (S5)	
___ Stripped Matrix (S6)	
___ Dark Surface (S7) (LRR R, MLRA 149B)	

Indicators for Problematic Hydric Soils³:

☐ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
☐ Coast Prairie Redox (A16) (**LRR K, L, R**)
☐ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
☐ Dark Surface (S7) (**LRR K, L**)
☐ Polyvalue Below Surface (S8) (**LRR K, L**)
☐ Thin Dark Surface (S9) (**LRR K, L**)
☐ Iron-Manganese Masses (F12) (**LRR K, L, R**)
☐ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
☐ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
☐ Red Parent Material (F21)
☐ Very Shallow Dark Surface (TF12)
☐ Other (Explain in Remarks)

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No _____

Remarks:

Soils not observed during the second monitoring year (2020).

ERM has over 160 offices across the following countries and territories worldwide

Argentina	The Netherlands
Australia	New Zealand
Belgium	Norway
Brazil	Panama
Canada	Peru
Chile	Poland
China	Portugal
Colombia	Puerto Rico
France	Romania
Germany	Russia
Ghana	Senegal
Guyana	Singapore
Hong Kong	South Africa
India	South Korea
Indonesia	Spain
Ireland	Sweden
Italy	Switzerland
Japan	Taiwan
Kazakhstan	Tanzania
Kenya	Thailand
Malaysia	UAE
Mexico	UK
Mozambique	US
Myanmar	Vietnam

ERM's Boston Office

One Beacon Street, 5th Floor
Boston, MA
02108

T: +1 617 646 7800

F: +1 617 267 6447

www.erm.com